SELECTED TOPICS
In Aerospace Engineering

EDITOR

ERWIN SULAEMAN

IIUM Press
INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

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Published by:
IIUM Press
International Islamic University Malaysia

First Edition, 2011

Perpustakaan Negara Malaysia Cataloguing-in-Publication Data

ISBN: 978-967-418-145-1

Member of Majlis Penerbitan Ilmiah Malaysia – MAPIM
(Malaysian Scholarly Publishing Council)

Printed by :
IIUM PRINTING SDN.BHD.
No. 1, Jalan Industri Batu Caves 1/3
Taman Perindustrian Batu Caves
Batu Caves Centre Point
68100 Batu Caves
Selangor Darul Ehsan
Tel: +603-6188 1542 / 44 / 45 Fax: +603-6188 1543
EMAIL: iiumprinting@yahoo.com

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ANALYTICAL DERIVATION OF THE INCOMPLETE CYLINDRICAL FUNCTIONS: REAL PARTS

19.1. Introduction

Evaluation of the incomplete cylindrical function B_n in describbed in previous chapter has been solved in an exact closed form by Ueda based on an expansion series [Ueda, 1981 and 1982]. Ueda (1981) presents tables and curves of the series for $n = 1$, and Ueda (1982) gives a general formula for $n > 0$, but there is no detail derivation of the series in both references. Since the series is one of key points in the present work, it is worthwhile to derive the series with emphasis to the treatment of the singular terms. The present derivation follows the prove of Ueda's expansion series given in Sulaeman (1993).

Recall th

e definition of the improper integral function in Equation (1)

$$B_h = \int_{-\infty}^{x} \frac{e^{iku}}{(r^2+u^2)^{h+1/2}}\, du \tag{19.1}$$

where it is more convenient to divide the function into two parts

$$B_h = B_{hr} + iB_{hi}$$

Where

$$B_{hr} = \int_{-\infty}^{x} \frac{\cos ku}{(r^2+u^2)^{h+1/2}}\, du = \int_{0}^{x} \frac{\cos ku}{(r^2+u^2)^{h+1/2}}\, du + \int_{0}^{\infty} \frac{\cos ku}{(r^2+u^2)^{h+1/2}}\, du \tag{19.2a}$$

and